CLAIMS

1. A high-hardness conductive diamond polycrystalline body formed substantially with diamond, wherein

said diamond has a maximum particle diameter of at most 100 nm and an average particle diameter of at most 50 nm, and a particle of said diamond includes at least 10 ppm and at most 1,000 ppm of boron.

2. The high-hardness conductive diamond polycrystalline body according to claim 1, wherein

said diamond has a specific resistance of at most 10 Ωcm.

3. The high-hardness conductive diamond polycrystalline body according to any of claims 1 and 2, wherein

said diamond has a maximum particle diameter of at most 50 nm and an average particle diameter of at most 30 nm.

4. The high-hardness conductive diamond polycrystalline body according to any of claims 1 and 2, wherein

said polycrystalline body has a hardness of at least 80 GPa.

5. The high-hardness conductive diamond polycrystalline body according to claim 4, wherein

said polycrystalline body has a hardness of at least 110 GPa.

6. A method of producing a high-hardness conductive diamond polycrystalline body, wherein

graphite including boron is mechanically milled with a tool including a planetary

ball mill in an inert gas to form a graphite-type carbon material including amorphous or fine boron, and the graphite-type carbon material is directly converted into diamond and concurrently sintered at a temperature of at least 1,500 °C and in a pressure condition wherein diamond is thermodynamically stable without adding a sintering aid or a catalyst thereto.

7. The method of producing a high-hardness conductive diamond polycrystalline body according to claim 6, wherein

said graphite-type carbon material including amorphous or fine boron has a maximum particle diameter of at most 100 nm.

8. The method of producing a high-hardness conductive diamond polycrystalline body according to claim 6, wherein

said graphite-type carbon material including amorphous or fine boron has a maximum particle diameter of at most 50 nm.

9. The method of producing a high-hardness diamond polycrystalline body according to claim 6, wherein

said graphite-type carbon material including amorphous or fine boron has a crystallite size of at most 50 nm, said crystallite size is obtained from a half-width of a (002) diffraction line of an X-ray diffraction pattern of said graphite-type carbon material.

10. The method of producing a high-hardness diamond polycrystalline body according to claim 6, wherein

said graphite-type carbon material including amorphous or fine boron has a crystallite size of at most 10 nm, said crystallite size is obtained from a half-width of a (002) diffraction line of an X-ray diffraction pattern of said graphite-type carbon

material.

11. The method of producing a high-hardness diamond polycrystalline body according to claim 6, wherein

a (002) diffraction line is unrecognizable in an X-ray diffraction pattern of said graphite-type carbon material including amorphous or fine boron.

12. A high-hardness conductive diamond polycrystalline body formed substantially with diamond, wherein

said diamond has a maximum particle diameter of at most 10,000 nm and an average particle diameter of at most 5,000 nm, and a particle of said diamond includes at least 1,000 ppm and at most 100,000 ppm of boron.

13. The high-hardness conductive diamond polycrystalline body according to claim 12, wherein

said diamond has a specific resistance of at most 1 Ωcm.

14. The high-hardness conductive diamond polycrystalline body according to any of claims 12 and 13, wherein

said diamond has a maximum particle diameter of at most 1,000 nm and an average particle diameter of at most 500 nm.

15. The high-hardness conductive diamond polycrystalline body according to any of claims 12 and 13, wherein

said polycrystalline body has a hardness of at least 80 GPa.

16. The high-hardness conductive diamond polycrystalline body according to claim 15, wherein

said polycrystalline body has a hardness of at least 110 GPa.

17. A method of producing a high-hardness conductive diamond polycrystalline body, wherein

a carbon material including at least 10 ppm and at most 100,000 ppm of boron is directly converted into diamond and concurrently sintered in a pressure condition wherein diamond is thermodynamically stable without adding a sintering aid or a catalyst thereto.

18. The method of producing a high-hardness diamond polycrystalline body according to claim 12, wherein

said carbon material including boron is amorphous carbon.

19. The method of producing a high-hardness diamond polycrystalline body according to claim 12, wherein

said carbon material including boron is graphite-type carbon.

20. The method of producing a high-hardness diamond polycrystalline body according to claim 12, wherein

said carbon material including boron is formed with graphite-type carbon and boron carbide.

21. A method of producing a high-hardness conductive diamond polycrystalline body, wherein

said carbon material including boron is diamond-like carbon, and is sintered without adding a sintering aid or a catalyst thereto.